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Case No.: LORAN-002A **A CLEAN VERSION WITHOUT MARKINGS**

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ELECTRONIC VEHICLE MONITORING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not Applicable

STATEMENT RE: FEDERALLY SPONSORED RESEARCH/DEVELOPMENT

[0002] Not Applicable

BACKGROUND OF THE INVENTION

[0003] The present invention relates generally to systems and methods for tracking the location of motor vehicles, and more particularly to an improved system and method for tracking the location of a plurality of motor vehicles at a particular location or lot to ascertain the exact position at which any motor vehicle is parked, as well as when a motor vehicle enters or leaves the location or lot.

[0004] Locations at which a relatively large number of motor vehicles are stored present the problem of determining exactly where each motor vehicle is located, and even whether or not a particular motor vehicle is located at a particular location or lot when the business has several different lots. This problem is particularly common to large motor vehicle dealerships, and is equally applicable to automobiles, trucks, recreational vehicles, or other similar motor vehicles. In addition, such businesses must also deal with the theft of motor vehicles, wherein one or more motor vehicle is illegally removed from the location or lot.

[0005] A number of different methods have been used in the past to deal with the problem of tracking the location of a large number of motor vehicles at a location or lot. The oldest of these methods is by keeping an inventory register of each motor vehicle and its location, either in a paper journal of some kind or, more recently, in a computerized database. Inventory registers depend on each individual who may move a motor vehicle for any reason recording that move, as well as the motor vehicle's new location. Ultimately, this system will not accurately reflect the location of all motor vehicles simply because not all employees at the location will enter each

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move of a motor vehicle. Similarly, another common system which relies on the placement of the keys of each motor vehicle on a large board in a position reflecting the location of the motor vehicle also requires the full time cooperation of each person at the location or lot, and hence also will not work all of the time due to human nature.

[0006] As might be expected, a variety of different approaches have been taken to attempt to solve the problem of monitoring large numbers of motor vehicles at a location or a lot. These approaches vary widely, encompassing both increased security measures and electronic vehicle monitoring. With regard first to increased security measures of particular application to motor vehicles at a location or lot, the measures taken commonly include security fences or compounds, the use of video monitoring of areas in which motor vehicles are stored, the use of motion sensors in such areas, and the use of security guards to patrol such areas. While such approaches may reduce the incidence of theft somewhat, they are not useful in addressing the primary problem contemplated by the present invention, namely how to track the location of a number of motor vehicles located at a particular location or lot.

[0007] The electronic security measures mentioned above also vary widely, from the use of electronic cards, to highly complex electronic motor vehicle communication systems, to the use of simple electronic motor vehicle tags which may be read as a motor vehicle passes a location having an electronic tag reader.

[0008] An example of the use of electronic cards associated with each motor vehicle is illustrated in United States Patent Number 5,459,304 to Eisenmann, which discloses a smart card for containing a variety of information pertaining to a particular motor vehicle. The electronic card approach is not helpful to the situation contemplated herein, since it does not contain information pertaining to the location of a motor vehicle, but rather information about a particular motor vehicle and its owner and operator.

[0009] An example of the use of an electronic motor vehicle communication system is illustrated in United States Patent Number 5,552,789 to Schuermann, which teaches a highly complex system for performing a variety of functions in the vehicle. The Schuermann system is simply too complex and too expensive to find application in the present situation.

[0010] Example of electronic motor vehicle tags which may be read by an electronic tag reader are found in Schuermann, as well as in United States Patent Number 5,311,186 to Utsu et al., United States Patent Number 5,635,693 to Benson et al., and United States Patent Number

5,661,473 to Paschal. Schuermann describes the use of a transponder on each motor vehicle, which may be used for premises or toll access. Utsu et al. teaches a communication system between a motor vehicle transponder and a device for interrogating the transponder. Paschal teaches such a system which may be used to automatically identify stolen motor vehicles. Benson et al. is perhaps the most detailed of such electronic motor vehicle tag/electronic tag reader systems, and a brief description of the Benson et al. system is illustrative of both the benefits and the limitations of such systems, as they are currently known. The Benson et al. system attempts to resolve the situation addressed by the present invention by electronically and automatically tracking motor vehicles as they enter and leave a dealership lot. An electronic tag located in each motor vehicle is read whenever that motor vehicle passes an electronic checkpoint at an entrance to or exit from the location or lot. The present invention's central monitoring station tracks all the motor vehicles at a location as they enter the lot or leave the location without the use of electronic entrance checkpoint readers.

[0011] While the Benson et al. system is highly useful and represents a significant improvement in the art, it does not address the problem addressed by the present invention, namely maintaining the location of motor vehicles at a location or lot. The Benson et al. system is not capable of determining where on a location or lot each motor vehicle is, but rather only information relating to each motor vehicle entering or leaving a location or lot.

[0012] Another example of mobile object tracking system is illustrated in the United States Patent Number 5,631,642 to Brockelsby et al., which describes an array of signpost stations distributed in an area and a vehicle based beacon transmitter arranged to transmit a vehicle identification signal and a vehicle location signal. The Brockelsby et al. system does not address the problem addressed by the present invention namely maintaining the location of a particular motor vehicle at a particular parking space. The Brockelsby et al. system is not capable of determining where on a location or lot each motor vehicle is parked, but rather only information relating to each motor vehicle passing a street corner or a wide area in a town.

[0013] Example of a method for retrieving vehicle collateral United States Patent Number 6,025,774 to Forbes illustrates a vehicle equipped with GPS antenna receiver and a cellular phone capable of transmitting location data regarding the vehicle and monitoring default loan status and establishing a data link from a base terminal to the transmitter of the vehicle upon an

occurrence of the default. The transmitter is capable of sensing any physical tampering therewith and transmitting a tampering signal in response to any sensed tampering.

[0014] The present invention uses a tamperproof GPS receiver and a cellular phone modem or two-way pager for location identification. In the present invention each one of said vehicle transceiver unit, GPS antenna/receiver and the GPS base cellular phone unit is equipped with a pressure sensing tamper switch mounted on the mounting surface side against said vehicle body (windshield) to monitor security violation and location of a particular vehicle at a site. The vehicle ignition or fuel pump has electronic circuitry communicating with an RF or Digital data with the vehicle mount GPS base Phone and Transceiver unit. If an unauthorized attempt is made to tamper or remove any of said units, said vehicle mount GPS based phone and the RF transceiver unit will transmit a signal to interrupt the ignition or fuel pump of said particular vehicle by use of RF communication or digital data link, and send a security violation tamper signal to a monitoring station. The Forbes system fails to describe the presence of a GPS base phone and vehicle transceiver unit with tamper-sensing circuitry which will immobilize a vehicle starter, ignition or fuel pump and signals a monitoring station after the tamper-sensing circuitry detects unauthorized removal of a GPS base phone or transceiver unit. While Forbes' "physical tampering detection signal" may be received by a monitoring station, such system cannot locate the vehicle, due to the fact in Forbes teaching, after a vehicle GPS equipment is tampered with, the vehicle is not immobilized. For example, the vehicle could be in motion, and the GPS/phone unit, depending on damage severity caused during tamper, could be inoperative, and the monitoring station thus being unable to identify where a moving vehicle location is. Contrary to the present invention, if and when vehicle RF or GPS/phone units are tampered with, the monitoring station upon receipt of a tamper signal from said vehicle unit, can locate the particular vehicle based on the last known vehicle location due to fact the tampered vehicle is immobilized and the last location is known to a monitoring station.

[0015] An example of Asset Location System U.S. Patent No. 6,069,570 to Herring illustrates an Asset Location System, wherein an asset is equipped with a pager receiver, a GPS receiver and a cellular phone communicating with a monitoring station. When a movable asset is to be located, a call is sent out to an asset equipped with a pager. When the pager receives said signal it powers-up the GPS antenna and the cellular phone to send location information to a central station relating to a particular asset.

[0016] The present invention teaches a GPS based phone or two-way pager installed in a vehicle and operating in a stand by mode (not being powered-up by a pager signal as Herring) and is equipped with a tamper sensing switch on its mounting side against the vehicle, utilized to immediately notify a monitoring station (contrary to Herring, a pager call is sent) and immobilize vehicle ignition upon said switch detecting unauthorized removal of said GPS antenna, mobile phone, two way pager and/or vehicle transceiver unit.

[0017] An example of Programmable Vehicle Monitoring United States Patent Number 5,986,543 to Johnson, describes a vehicle security system with intrusion detecting device connected to a GPS base unit. When intrusion takes place, said vehicle GPS base phone transmits an intrusion signal to a central monitoring station which will identify and locate said vehicle. In addition, the monitoring station is capable sending a signal to shut said vehicle ignition or fuel pump and Lock/unlock doors via the mobile phone installed in said vehicle. The intrusion detecting RF transceiver and GPS based phone units used in the present invention are tamper sensing and use a pressure sensing switch mounted in a vehicle against the vehicle body or as described in the invention mounted within rear view mirror (camouflaged), which is a substantial improvement over prior art Johnson system. If the GPS or RF transceiver or cellular modem unit is being tampered with (disconnected or removed), the vehicle intrusion detecting RF transceiver unit will transmit a RF tamper signal, and the GPS based phone unit will transmit a tamper signal to a central monitoring station that additionally will shut down said vehicle ignition or fuel pump, contrary to Johnson, without the need of receiving command from a central monitoring station, and the low power base station RF transceiver sends signals to control particular vehicle engine in a lot without the acquiring cost. Such system is contrary to Johnson, which teaches a monitoring station sending signals to immobilize the vehicle engine and lock/unlock doors via costly phone service.

[0018] An example of Car Rental System is United States Patent Number 5,289,369 to Hirshberg, which describes a vehicle and a central control equipped with a computer keyboard and a Monitor, in a car rental system, with the user using a card access to operate vehicle mount control system. The system comprises means for detecting in a real time the exact location of a rental car while traveling by means of street intersection post mount transceivers communicating with a rental car system to indicate driver vehicle location and the street transceiver being

connected by use of phone line or other means, communicating to central control unit, indicating to said central control said street transceiver and vehicle location.

[0019] The present invention utilizes plurality of vehicle transceiver units and does not require a driver access card, in order to operate vehicle installed transceiver unit. The Hirshberg system is not capable of determining where on a parking lot each motor vehicle is parked, but rather only information relating to each motor vehicle passing a street in a town. As such, the present invention is capable of identifying the particular location of each vehicle at a location in a parking space that is performed by use of unidirectional infrared and/or electromagnetic communication signals between vehicle transceiver unit and parking space units (with 6-8 feet range), without interfering the communication between other parking space unit(s) and vehicle transceiver unit(s) located within next to its proximity (approx. 6 feet apart). Since the Hirshberg system uses (Omni directional) RF signal to communicate between vehicle and street transceiver unit, if one were to relocate Hirshberg's pole mount transceivers from that of street corner locations into a plurality of parking space slots (6 feet apart) from each other to communicate with vehicle mount transceiver unit in a lot. for the purpose of plurality of vehicles and plurality of parking space unit to communicate next to each other's proximity, in such a close parking slot the use of Hirshberg's post mount transceivers and vehicle mount transceiver units would definitely interfere each other. The vehicle mount transceiver will not be able to determine one post unit location from the other. Therefore, the Hirschberg system cannot operate in a parking lot, and be able to identify a particular vehicle location at a particular parking space, due to signal collision between the vehicles and parking space units. The location identification will definitely be misread. In addition the Hirschberg central control system fails to retrieve from a particular vehicle transceiver unit the location of said vehicle, in a particular parking space on a lot.

[0020] An example of a Vehicle Waiting Time indicator is disclosed in United States Patent Number 5,163,000 to Rogers, which describes a vehicle service station having multiple lanes; and each lane has one or more sensors for sensing the presence of vehicles in each lane. Each station computer is responsive to the lane sensors for computing the waiting time for a particular vehicle.

[0021] The present invention is not used for monitoring vehicles waiting in line to be serviced. The prior art "Roger" invention does not teach a station computer capable of

communicating with a vehicle mount RF transceiver unit and identifying each one of said particular vehicle information parked at a particular parking space.

[0022] An example of a Hired Vehicle Transportation System is disclosed in United States Patent Number 5,726,885 to Klein et al. that teaches a Hired Vehicle Transportation system wherein a plurality of usable vehicles are available for hire with one or more collection and return points. A control center is equipped with an automatic collection and return mechanism which issues authorized persons driving authorization for the vehicles parked at the respective collection and return points in the form of associated vehicle keys and return the keys of the vehicle at the end of a journey. The disposition center ascertains the individual availability of vehicles and makes reservations.

[0023] The present invention is an improvement over "Klein's Automatic Key Collection and return machine wherein each one of said Vehicle Key Track Units (Key Dispensers) is equipped with a computer, a keyboard, a monitor to indicate vehicle information and location on a lot and a user Finger Print Reader and RFID (transponder) Key reader. When an authorized person puts his finger on a "key track" finger read scanner, the "Key Track" unit upon reading a person's valid (pre-programmed) fingerprint pattern, signals to the user to enter (through said Keyboard) a selected vehicle ID code (VIN Number). Upon receipt of the selected vehicle ID code, The Key Track unit will dispense a particular vehicle key containing RFID Tag to an authorized user. Said vehicle Key RFID Tag information will be read by said Key Track Unit, and said Key Track unit will indicate a particular vehicle Key is being checked out from its inventory, and memorize the person's ID information who took a particular vehicle key at a particular site at a particular time. When the user dispenses back said vehicle Key into the "Key Track" unit, the Key Track Unit reads the RFID Key Information and logs back in its inventory the presence of a particular vehicle Key, and time stamps in its memory.

[0024] In the present invention a plurality of said Key Track Units could be installed in different sites. Each one of site Vehicle Key Track Units are interfaced to Each other via a network of computers of by a Web server.

[0025] Additionally, said Key Track Unit is equipped with a microphone. A voice recognition processor and a speaker are used to give verbal instruction to the user. For user identification, it utilizes a user voice recognition system to dispense a particular vehicle key. In the preferred embodiment of the present invention, the user gives verbal commands in order to

select a particular vehicle and receives the particular vehicle keys from said Key Track Unit without the use of a keyboard.

[0026] The present invention teaches a Key Track System in which only authorized personal who's fingerprints and or voice is preprogrammed into said Key Track unit can get access to particular vehicle keys found in a "Key Track" System.

[0027] It is the primary objective of the present invention that it provides an electronic vehicle tracking information system which will track the present location of each of a plurality of motor vehicles at a location in a lot, such as for example a motor vehicle dealership. As such, the Electronic Vehicle Monitoring System of the present invention is capable of identifying the particular location of each motor vehicle at a location in a parking space that is performed by the use of directional infrared (Ultrasonic) or electromagnetic communication signals between a vehicle transceiver unit and parking space units, without interfering with the communication between parking space units and vehicle transceiver units located next to each other thus eliminating any possibility of a vehicle transceiver to misread a parking space unit next to it.

[0028] It is a further objective of the Electronic Vehicle Monitoring System of the present invention to be capable of automatically determining when each motor vehicle at a location or lot entered in to a base station computer interface unit when the vehicle ignition is turned off. The base station computer is also capable of determining vehicle presence in the lot or at a particular parking space location by signaling a particular vehicle transceiver with a unique code, and the vehicle transmitting a unique coded signal back to the base station computer interface unit identifying its presence and location on the lot at a particular parking space.

[0029] The present invention is capable of optionally providing additional features in the nature of motor vehicle security system to each vehicle. It is still further an objective of the present invention to provide a mechanism whereby information located at a base station can be transmitted to a particular motor vehicle which might include a command to start or stop vehicle engine; to arm or disarm the alarm unit or lock and unlock the doors. To exchange information identifying a particular vehicle; ascertain the location of a particular vehicle location by use of tamper proof GPS receiver unit and able to inventory control plurality of motor vehicle located on a lot; time stamp vehicle presence and absence and control car Key track (Automated Key dispenser); and additionally to report any security violation to a central monitoring station, by use of a digital or voice "Auto dialer".

[0030] Finally, the Electronic Vehicle Monitoring System of the present invention, wherein the vehicle transceiver and the GPS unit are of a tamper proof design, if an unauthorized attempt is made to tamper with, remove or cut the harness, the vehicle ignition or fuel line will be immobilized, the vehicle horn will honk, and the presence of tampering with a vehicle mount GPS unit will be reported to a monitoring station via a cellular, UHF, or Satellite modem.

[0031] Nevertheless, the Hirshberg system United States Patent Number 5,289,369 as well as the other electronic vehicle tracking systems mentioned above are important and useful background to the present invention. Accordingly, United States Patent Number 5,311,186 to Utsu et al., United States Patent Number 5,552,789, to Schuermann, United States Patent Number 5,635,693, to Benson et al., United States Patent Number 5,661,473, to Paschal, United States Patent Number 5,631,642 to Brockelsby, United States Patent Number 6,025,774 to Forbes, United States Patent Number 6,069,570 to Herring. United States Patent Number 5,986,543 to Johnson. United States Patent Number 5,163,000 to Rogers, United States Patent Number 5,726,885 to Klein et al. are each herby incorporated by reference.

BRIEF SUMMARY OF THE INVENTION

[0032] The disadvantages and limitations of the background art discussed above are overcome by the present invention. With this invention, interacting electronic components are located in each motor vehicle to be monitored, in each parking slot at a location or lot such as, for example a motor vehicle dealership in which the motor vehicles may be stored, and at a base station from which the Electronic Vehicle Monitoring System of the present invention is to be operated.

[0033] A motor vehicle at the motor vehicle dealership contains a vehicle unit which is mounted in the motor vehicle and which includes a low power infrared or electromagnetic transmitter. The signals from the vehicle unit are short range directional so that they can only be received by a parking space unit when the motor vehicle is parked in the parking slot in which the parking space unit is mounted with the transceiver receiving and transmitting an RF signal which identifies the particular vehicle unit.

[0034] Each parking space unit which is located at each parking space in the motor vehicle dealership contains an infrared or electro-magnetic receiver to receive infrared or electro-magnetic signal from a motor vehicle unit parked in that particular parking slot. A transmitter to transmit a radio frequency (RF) signal which identifies the particular parking space in which the parking space unit is located is also provided.

[0035] Thus when a motor vehicle is parked in a particular parking slot. Upon vehicle ignition, the system is turned off, the vehicle unit transmits a infrared or electro-magnetic signal, the parking space unit receives the infrared or electro-magnetic signal, and from the vehicle unit. The parking space unit upon receiving the infrared or electro-magnetic signal transmits a RF signal identifying the particular parking slot in which the parking space unit is located. Additionally the vehicle unit, upon the vehicle's ignition system being turned off, transmits a secondary RF signal identifying the particular vehicle unit.

[0036] In the present invention, the parking space unit is also capable of transmitting a RF signal identifying both the particular motor vehicle unit and particular parking space unit. In addition in the present invention the plurality of parking space units could signal the vehicle transceiver units by means of a motion detector or pressure sensor switch installed in a plurality of parking spaces. When a vehicle enters a particular parking space area, the sensor detects the vehicle movement and signals the parking space unit and upon receiving the signal, transmits a RF signal identifying both the particular motor vehicle unit and particular parking space unit.

[0037] In a preferred embodiment of the present invention, the base station computer interface unit signals a plurality of vehicle units and the vehicle units signals a particular parking space unit. The parking space unit upon receiving the signal transmits an infrared or electromagnetic signal to a vehicle unit and the vehicle unit signals with an RF signal to a base station unit information containing both the particular vehicle unit and particular parking space unit.

[0038] The RF signal from each of the vehicle units and parking space units are provided to a base station transceiver unit which is connected to a computer to store and maintain information relating to the vehicle and its location.

[0039] The base station computer is capable of monitoring the presence and location of the vehicles located on the lot periodically at a set time by transmitting a RF signal to the vehicle and

parking space units to send a RF signal back to the base station unit containing information relating to the presence of particular vehicles and their locations.

[0040] In an additional aspect of the present invention, the base station is capable of monitoring a motor vehicle on a lot without the use of parking space units. In this aspect the base station computer can give a user information relating to a particular vehicle's presence and absence on a lot for a particular time.

[0041] Optionally, additional features may be included in the vehicle unit, for example, a motor vehicle security system may be integrated into the vehicle unit for monitoring access to the motor vehicle through the use of an ignition switch sensor, a motion sensor, door, hood or trunk sensors, etc. Motor vehicle lights and horn or an alarm siren may also be monitored. The vehicle unit in the present invention is capable of signaling the base station unit. The signal from the vehicle to base station is transmitted by a RF signal. In the present invention, the security violation signal could be transmitted to a base station by means of an auto dialer phone or a pager installed within the vehicle. The base station computer is capable of transmitting RF signals containing special data to preselected motor vehicles containing a vehicle unit. Such data, including commands to immobilize the vehicle engine, lock or unlock doors, start the vehicle engine, arm and disarm the vehicle alarm system, and transmit vehicle ID information or control a car key track unit, and giving access to vehicle key to authorized individual may be transmitted.

[0042] In the present invention, a plurality of vehicles could be equipped with a GPS antenna and the monitoring station could locate a particular vehicle location in the event of a security violation (such as a stolen vehicle). The base station could monitor the speed of the stolen vehicle and shut down the particular vehicle's ignition or fuel pump at a safe speed. Additionally, a remote control may be provided to control the vehicle security system integrated into vehicle unit. In this case the vehicle unit will be of use in determining when the vehicle visits the motor vehicle dealership, for example, for service.

[0043] In an alternate embodiment, the parking space units may be hard-wired to the base station instead of using RF for these components to communicate with each other. It may therefore be seen that the present invention teaches an electronic vehicle monitoring system which will trace the present location of each of a plurality of motor vehicles at a location or lot such as a motor vehicle dealership. As such, the Electronic Vehicle Monitoring System of the

present invention is capable of identifying the particular location of each motor vehicle at the location or lot. The monitoring of motor vehicle locations at the location or lot can be performed completely, automatically by the Electronic Vehicle Monitoring System of the present invention, without requiring any information regarding location or movement of motor vehicles to be manually provided to the system when the same is operating.

[0044] The Electronic Vehicle Monitoring System of the present invention is capable of automatically determining when each motor vehicle at the location or lot enters or leaves the location or lot without the use of gate units. Optionally the electronic vehicle tracking information system of the present invention is capable of providing additional features in the nature of a motor vehicle security system to each vehicle if desired.

[0045] The Electronic Vehicle Monitoring system of the present invention is capable of determining when a vehicle transceiver or GPS unit has been tampered with by the use of a tamper proof switch on the mounting side of the vehicle with the GPS unit sensing removal or tampering of the units from the vehicle. When such violation takes place, both the vehicle transceiver and GPS unit will transmit a signal to the vehicle ignition circuitry to immobilize the vehicle engine, honk the car horn, flash the lights and transmit said security violation signal to a monitoring station.

[0046] The Electronic Vehicle Monitoring System of the present invention is both durable and of long lasting nature, and it will require little or no maintenance to be provided by the user throughout its operation lifetime. The electronic Vehicle Monitoring System of the present invention is also of relatively inexpensive construction to enhance its market appeal and to thereby afford it the broadest possible market.

BRIEF DESCRIPTION OF THE DRAWINGS

[0047] Figure 1 is a General Block Diagram of Electronic Vehicle Monitoring System.

[0048] Figure 2 is an Electronic Vehicle Monitoring System, wherein a vehicle transceiver unit initiates a signal to a parking space transceiver unit, and parking space and vehicle transceiver units communicate with the base computer.

[0049] Figure 3 is an Electronic Vehicle Monitoring System, wherein a parking space transceiver unit, initiates a signal to a vehicle transceiver unit. The vehicle and the parking space

transceiver unit communicates with the base station computer connected to an electronic Key Track system.

[0050] Figure 4 is an Electronic Vehicle Monitoring System, wherein a vehicle transceiver unit communicates with a parking space transceiver unit and the vehicle transceiver unit communicates with the base station computer.

[0051] Figure 5 illustrates a tamper proof adhesive mounted vehicle RF transceiver unit.

[0052] Figure 5B illustrates a tamper proof magnet or bracket mounted vehicle RF transceiver and GPS based cellular or satellite transceiver unit.

[0053] Figure 5C illustrates a side view of Figure 5A and 5B.

[0054] Figure 5D illustrates a tamper proof rear view mirror having a vehicle RF transceiver and GPS antenna with mobile phone transceiver system.

[0055] Figure 6A illustrates a tamper proof vehicle transceiver unit mounted into a vehicle windshield or mirror.

[0056] Figure 6B illustrates a tamper proof vehicle transceiver with GPS unit mounted on a vehicle with a bracket or magnet.

[0057] Figure 7 illustrates the base station computer database.

DETAILED DESCRIPTION OF THE INVENTION

[0058] The preferred embodiment of the electronic vehicle monitoring system is illustrated in Figure 1 indicating a base station computer 21, which is the main control center, that contains all necessary data to communicate with base station transceiver unit 20 which is used to receive data, log in parking space and vehicle location information, initiate commands, and to communicate with electronic Car Key Track system 24 to keep all Key Track and user records, provide vehicle location info to said Key Track machine 24, which displays the information on the Key Track monitor 29. The base station transceiver 20 communicates with vehicle transceiver unit 23, which sends and receives vehicle and parking space unit data through RF signal. The invention uses a base station transceiver unit 20 to communicate with parking space transceiver unit 22 by sending a signal to parking space unit 22 and receiving back parking space unit 22 and vehicle transceiver unit 23 data with an RF or hard wire signal. The communication between the vehicle transceiver unit 23, and the parking space unit 22, is performed through a directional infrared and or RF electromagnetic transceiver unit 30. In the present invention, the

parking space unit 22 could be connected to a motion sensor 40, or a switch sensor 41, to determine the presence of a motor vehicle at a particular parking space, and the sensors 40 and 41 communicating with the parking space transceiver unit 22 to generate a communication link with the vehicle transceiver unit 23 parked in at the particular parking space. The present invention in addition, to RF communication, for additional distance coverage and security, may utilize the mobile phone or radio pager unit 28 to receive and transmit data between the base station computer unit 21 and the vehicle transceiver unit 23. In addition, a GPS antenna receiver unit 50 is connected to the mobile phone / radio pager unit 28, which transmits vehicle location information to the monitoring station. The GPS antenna unit 50 could be connected directly to vehicle RF transceiver unit 23 in which vehicle location data will be transmitted via a mobile phone / radio pager unit 28 to a base station 21, or vehicle location information could be sent to a monitoring station.

[0059] The Electronic Vehicle Monitoring system's vehicle transceiver unit 23 used in the invention, by receiving commands from base station computer 21, is capable of controlling the vehicles lights 12, horn 13, engine immobilization 18, central door locking / unlocking 14, and report an intrusion alarm to a base station computer by use of Door switch sensor 15, voltage drop sending circuitry 16, and shock or motion sensor 17 circuitry.

[0060] Figure 2 shows a plurality of parking spaces on a lot, having a plurality of parking space transceiver units 22, 42, 62 equipped with infrared or RF electromagnetic receivers, and a low power RF or hardwire transceiver. A vehicle 56 is also shown equipped with a unidirectional infrared or electromagnetic transmitter and an RF low power transceiver unit 23. A Base station transceiver 20, interfaced to a computer 21 communicating with said parking space transceiver units and said vehicle transceiver ~~init~~ unit is also depicted.

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[0061] A vehicle 56, equipped with a vehicle transceiver unit 23 is shown signaling with unidirectional short range (6-8 feet) infrared or electromagnetic coded signal 30, to a parking space transceiver unit 22, located on parking space 22, to indicate its presence. The parking space transceiver unit 22, upon receiving said signal, transmits through RF or hardwire a coded signal 52, a signal containing information for both the particular motor vehicle unit 23 and particular parking space unit 22, to a base station transceiver unit 20 which is interfaced to the base station computer 21, which logs in the computer's database said particular vehicle 56

present, time entered, and vehicle information, along with the particular parking space information that said vehicle 56 is parked in.

[0062] The vehicle transceiver unit 23 periodically will transmit a signal to said parking space unit 22, and said parking space unit 22, upon receiving said signal, will transmit said particular vehicle unit 23 and parking space transceiver unit 22 information to said base station transceiver unit 20, to update said computer database automatically with the information relating to the presence of the particular motor vehicle 56 at the particular parking space 22. In the present invention, the base station computer 21 can retrieve a particular vehicle location at a particular parking space in a lot, at any given time, by sending manual or automatic (scan) vehicle location command signals through an RF or Hardwire signal 51. If the vehicle 56 departs from the particular parking space 22, the base station computer 21, manual or automatic scan command can not communicate with a vehicle mount transceiver unit 23, the computer database deletes said vehicle 56 from it's database, as the vehicle is no longer part of the inventory system. If the Base station computer 21 cannot communicate with the vehicle transceiver unit 23, more then 2 intervals, due to vehicle were removed without prior vehicle removal entry into the base station computer database, the base station computer will initiate an alarm signal, and send said security violation signal to a central monitoring station or to a public pager network.

[0063] The present electronic vehicle monitoring system can be utilized if and when a vehicle is parked in a lot wherein there are no parking space transceiver units. In such application, said vehicle upon its ignition being turned off or emergency brake being pulled off, transmits an RF coded signal 10 indicating its presence on a lot. Said lot base station transceiver unit 20 will receive said vehicle transceiver unit signal, and the base station computer 21 interface logs said particular vehicle 56 info into it's database. The base station computer 21 initiates random or at select time intervals RF coded signal 11 through said base station transceiver unit 20, to communicate with a particular motor vehicle 56 transceiver unit 23 to verify the presence of the particular vehicle on the lot. If more then two intervals of communication attempt by the base station computer 21 does not generate a successful link between the base station computer 21 and the vehicle transceiver unit 23, the computer indicates the departure of the particular vehicle 56 from its inventory system. If and when the base station computers after two interval communication attempts cannot communicate with the particular

vehicle transceiver unit 23, due to vehicle being removed from the lot without prior removal authorization data entry into the computer, the computer 21 will initiate an alarm signal.

[0064] In the present invention, the vehicle RF transceiver unit 23 optionally is equipped with an intrusion alarm. The base station is capable receiving any security violation RF signal 10 from a vehicle transceiver unit 23 parked on the lot, such as a intrusion alarm, unauthorized vehicle door been open, a shock sensor being triggered, unauthorized vehicle ignition being turned on or vehicle voltage drop sensed due to a vehicle door being open, or ignition being turned on. In the present invention the base station computer 21 is capable of sending RF signal 11, to a particular vehicle unit 23, on a lot to Lock/unlock the doors, to flash the lights, to honk the horn and immobilize vehicle engine.

[0065] Figure 3 describes an Electronic Vehicle Monitoring system wherein a plurality of parking space transceivers units are installed at particular parking spaces 22, 42, and 62. Parking space transceiver 22 is equipped with unidirectional Infrared or electromagnetic transmitter, and an RF low power transceiver. Parking space transceiver 42 additionally is equipped with a motion sensor 40. Parking space transceiver unit 62 is equipped with a pressure-sensing switch. A vehicle 56 is equipped with a vehicle transceiver unit 23, having an RF infrared or electromagnetic receiver and a low power RF transceiver. In addition the vehicle transceiver unit 23 is connected to a mobile phone/radio page 28 with GPS antenna receiver unit 50. A base station transceiver 20 interfaced to a computer 21, which is connected to an electronic Key Track unit 24. The base station computer 21 communicates with said parking space units, vehicle transceiver units and Electronic Key Track unit 34.

[0066] A parking space unit 22 will transmit a unidirectional infrared or electromagnetic coded constant or time interval signal to a vehicle 56 equipped with an infrared or electromagnetic receiver unit 23 which will receive said signal 31, and transmit said data with a low power RF signal 10, containing information to both to the parking space transceiver unit 22, and vehicle transceiver unit 23, to a base station computer transceiver interface, which upon receipt of said signal logs in the particular vehicle 56 and parking space 22 info into its memory and displays said information on its monitor. The base station computer 21 can update itself regarding the presence or absence of a particular vehicle 56 at a particular parking space 22 by means of sending coded signal to the particular vehicle transceiver unit 23 via base station transceiver 20 by signaling with an RF or hardwire random or time interval (scan) signal 51 to

the parking space unit, and said parking space unit 22 retrieving data from said vehicle mount transceiver unit 23. The base station computer 21 also can retrieve data directly from the vehicle transceiver unit 23 by means of the base station computer 21 sending random or time interval RF signals 11 to a particular vehicle transceiver unit 23 and said vehicle transceiver unit 23. Upon receipt of said signal, RF signal 10 will be sent containing information for both vehicle and parking space transceiver unit.

[0067] The invention utilizes an additional method for signaling a vehicle transceiver unit, such as, the parking space transceiver 42 and the motion sensor. When a vehicle 56 enters the particular parking space 42, the motion detector 40 senses the presence of the motor vehicle 56 and the parking space transceiver unit 42 transmits a directional infrared or electromagnetic signal to the vehicle transceiver unit 23. The invention also teaches another method of signaling a vehicle unit, which is illustrated in Figure 3 where the parking space unit 62, is connected to a pressure-sensing switch 41 and when a motor vehicle 56 enters the particular parking space 62 it transmits a directional infrared or electromagnetic signal to the vehicle transceiver unit 23.

[0068] The Electronic Vehicle monitoring system of the present invention in addition to the use of RF transceiver unit 23, uses a GPS based 50 cellular phone or pager modem unit 28 for base station to be able to communicate and locate the motor vehicle location, especially when the motor vehicle(s) 56 to be monitored is out of particular parking space on the road where low power RF transceiver communication range becomes not useful. The RF transceiver 23, GPS 50, mobile phone/pager modem unit 28, used in the invention are tamper proof and each one of said units are equipped with a pressure sensing tamper switch 70, shown in Figure 5-A and the tamper switch sensing side of the units are mounted against the vehicle windshield 22 shown in Figure 6-A or mounted within rear view mirror 81 shown in Figure 6-A and or mounted against the vehicle body 24 shown in Figure 6-B. Said vehicle RF transceiver or GPS/phone units are communicating with an RF or hardwire signal with vehicle mount Immobilizer circuitry. If and when an attempt is made to tamper or remove the vehicle mount RF transceiver 23, GPS 50, or mobile phone/pager modem 28, the vehicle will be immobilized, such as by gradual fuel pump cut off, starter interrupt, ignition immobilization, etc.

[0069] The Electronic vehicle monitoring system is additionally capable of controlling an Electronic Key Track unit 24 which is equipped with a Keyboard 17 for user to select a desired

vehicle, a monitor 27 to indicate vehicle information and location on the lot, a user Finger print Bio-optic reader 25, and RFID (transponder) key reader 19.

[0070] When an authorized person puts his finger on Key Track finger read bio-optic scanner 25, the bio-optic scanner will read the person's valid (pre-programmed) fingerprint pattern. The Key Track unit displays on its monitor 27 for the user to enter a selected vehicle ID number by use of keyboard 17. The Key Track unit 24 upon receipt of selected vehicle ID codes dispenses the chosen vehicle key containing RFID tag. Said vehicle Key RFID Tag information is read by said Key Track RFID Key Tag reader 19, and said Key Track unit indicates a particular vehicle key being checked out from its inventory, and logs in the computer memory the person's ID information, which notes who took a particular vehicle key at a particular site at a particular time. When the user returns the vehicles key to the dispenser 82, the Key Track unit reads the key RFID information and logs back in it's inventory the presence of a particular vehicle key, and time stamps the key return event in it's memory.

[0071] Additionally the Key Track unit 34 is equipped with a microphone 33, a voice recognition processor and a speaker 34, used to give verbal instruction to the user. For user identification it utilizes user voice recognition technology. User gives its given password (pre-Recorded) through said microphone 33. Upon user voice recognition, The Key Track unit 24 allows the user to gets access to select a vehicle key. In the preferred embodiment of the present invention, user gives verbal commands in said microphone 33, to select a particular vehicle and receive the particular vehicle key without the use of the keyboard.

[0072] The invention also teaches another practical method of determining the presence of a motor vehicle at a particular parking space on a lot. As illustrated in Figure 4, there are a plurality of parking space units 22, 42, 62, along with a vehicle 56 equipped with directional infrared or electromagnetic transceiver unit, an RF low power transceiver unit 23, and a base station transceiver unit 20 with an antenna 98 interfaced with a computer 21.

[0073] When a vehicle 56 enters a particular parking space 22, the particular vehicle transceiver unit 23 transmits a directional infrared or electromagnetic signal. The parking space transceiver unit 22 receives said signal and upon receipt transmits a unidirectional infrared or electromagnetic coded signal towards the vehicle transceiver unit. The vehicle transceiver unit 23, upon receipt of said signal, transmits a RF low power signal containing information to said parking space unit 22 and to said vehicle transceiver unit 23, to a base station transceiver unit

which receives said signal using an antenna 98. Said base station transceiver interface 20 and base station computer 21 upon receipt of said signal, logs in the presence of said vehicle 56 and the parking space 22 information in its database memory.

[0074] As shown in Figure 5-A, the vehicle transceiver 23 of the present invention is tamper proof and has a pressure sensing tamper switch 70 protected by a protection metal "O" ring 74 and is mounted against the vehicle windshield or on to the vehicle body, by use of Velcro or double sided tape 72. The transceiver has an infrared Diode 71 opening to communicate with parking space units, and has an antenna 73, to communicate with base station computer interface unit 20. As shown in Figure 5-B, the vehicle transceiver additionally has a built-in GPS receiver antenna 78, and instead of Velcro mounting tape, the system utilizes a magnet 77 for mounting against vehicle body. The unit can also be mounted by use of mounting bracket 76. As shown in Figure 5-B, the vehicle transceiver unit utilizes the electromagnetic transceiver 75 GPS antenna and the mobile phone/pager unit that are implemented in a vehicle such that the same are highly undetectable by thieves. A further example is shown incorporating into a rearview mirror as shown in Figure 5-D.